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B8F FBG F25
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(54) **Pressure sensitive sheet material**

(57) A pressure sensitive thermoplastic sheet material suitable for use as a self-adhesive label material comprises a clear thermoplastic polyolefin film (1) which is covered on one side by a pressure-sensitive adhesive coating (3). The adhesive coating (3) encapsulates a layer of colourant (2) applied to said one side of the film. Preferably, the colourant (2) comprising a water-based thermoplastic acrylic copolymer base and a water miscible pigment. In a modification, a luminescent image (5), preferably one which comprises at least an infrared readable ink or an ultraviolet readable ink, is applied to the film (1) prior to application of the layer of colourant (2). This modification enables the invention to be used to provide a security label in anti-counterfeiting measures.

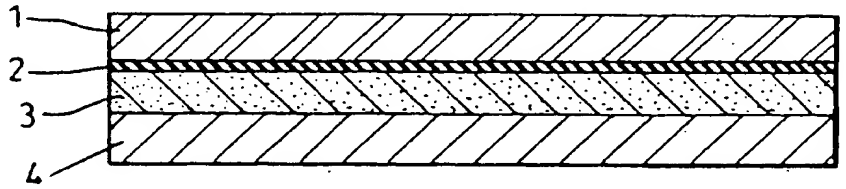

Fig. 1

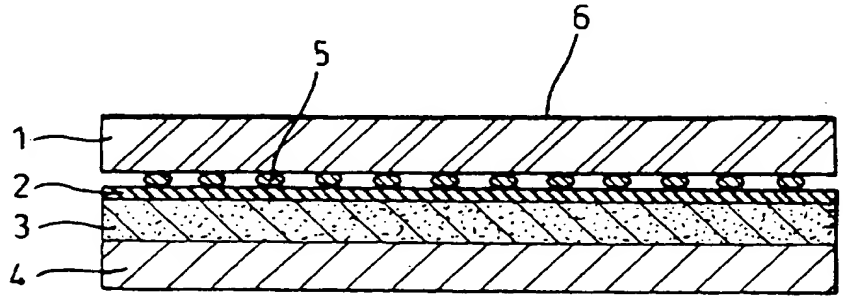

Fig. 2

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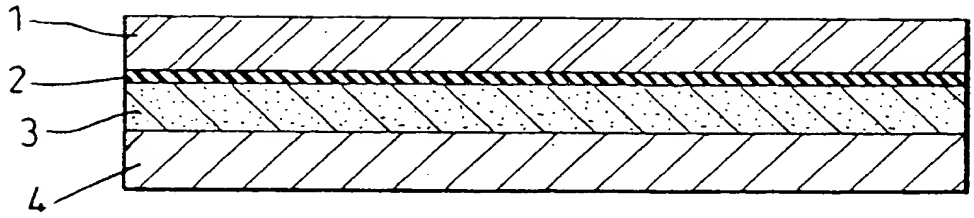

Fig. 1

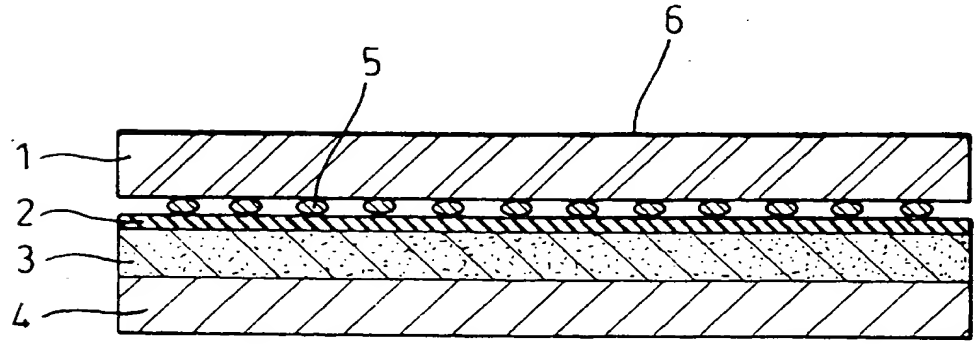

Fig 2

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PRESSURE SENSITIVE SHEET MATERIAL

The present invention relates to coloured pressure sensitive thermoplastic sheet materials such as can be produced in cut-sheet or roll form and are suitable for use as self-adhesive label material.

Conventionally, the only coloured thermoplastic sheet materials suitable for conversion into coloured pressure sensitive products such as labelstock and tapes comprise polyvinyl chloride. Typically coloured monomeric and polymeric vinyl sheets are used. Such sheets are made by a calendering process and as a result, in practice, minimum levels of each colour are limited to 1 tonne runs which yield an average, for labelstock, of 8000 m^2 of product. This makes colour stockholding expensive. In addition, adhesive selection is critical as monomeric vinyls leach plasticiser to the adhesive film as well as to the print surface. A reasonable lifespan would be only three years or so. Waste disposal is also important and must be carried out under strictly controlled conditions.

In contrast polymeric vinyl sheets do not suffer from the migration of plasticisers and thereby have a slightly longer lifespan of around five years or so. However, they are softer than monomeric vinyl sheets and any gloss finish applied to them is easily damaged by variations in storage temperature.

Both the aforementioned types of sheet require expensive waste disposal procedures to protect the environment and both products are difficult to recycle in volume.

Pressure sensitive labelstock can be produced using cast coated polyvinyl chloride (PVC) wherein the PVC is cast or coated on to a gloss release paper. However, because of the production process this labelstock is expensive to produce. In addition, this product is cast coated in an organosol paste form involving solvents which have to be incinerated in the machine exhaust or passed straight into the atmosphere. The latter alternative makes the product environmentally unfriendly at the manufacturing stage as well as at the disposal stage.

In contrast to the above, polyethylene and polypropylene sheets are environmentally friendly as they do not pose the same final waste disposal problems. They are fully recyclable at both the manufacturing stage and at final disposal. However, such sheets are not commercially available in a wide range of colours because of the high production costs involved; typically the clean-down time of the machinery used between the production of sheets of different colours makes such products economically unviable. Typically, therefore, such sheets are made in ranges comprising only some or all of gloss and matt clear, and gloss and matt white and black.

The object of the present invention is to provide a pressure sensitive thermoplastic sheet material such as would be suitable for use as labelstock which can be produced economically in a wide range of colours and which preferably overcomes or substantially mitigates the aforementioned environmental problems.

According to a first aspect of the present invention there is provided a pressure sensitive thermoplastic sheet material suitable for use as a self-adhesive label material comprising a clear thermoplastic polyolefin film which is covered on one side by a pressure-sensitive

adhesive coating, and characterised in that the adhesive coating encapsulates a layer of colourant applied to said one side of the film.

Thus, in the present invention and in contrast to the prior art, a clear thermoplastic film is used as a carrier for a layer of colourant rather than being coloured itself. This enables the final sheet material to be economically produced in a wide range and diversity of colours.

Preferably, a release liner is provided which covers the adhesive coating and which can be peeled off prior to use of the sheet material.

Preferably also, the clear thermoplastic film comprises one of a polypropylene film, polyethylene film, and a polyolefin film.

It is possible for uPVC films to be used in the invention but these would be associated with the environmental problems previously mentioned in connection with the prior art.

One of the difficulties to be overcome in the production of a pressure sensitive thermoplastic sheet material in accordance with the invention is to find a colourant which will successfully bind to a conventional pressure sensitive adhesive, such as a rubber-based pressure sensitive adhesive or a pure acrylic adhesive, both of which are water based.

In this regard, according to a second aspect of the present invention there is provided a pressure sensitive thermoplastic sheet material suitable for use as a self-adhesive label material comprising a clear thermoplastic

polyolefin film which is covered on one side by a pressure-sensitive adhesive coating, and characterised in that the adhesive coating encapsulates a layer of colourant applied to said one side of the film, the colourant comprising a water-based thermoplastic acrylic copolymer base and a water miscible pigment.

Preferably also, the pigment is substantially stable under ultraviolet irradiation up to 8 on the Gray scale.

In order to provide a sheet material suitable for use as a security label, a luminescent image is preferably present between the film and the layer of colourant. The luminescent image preferably comprises an image produced by the application of at least infrared readable or ultraviolet readable ink to the film prior to application of the layer of colourant.

According to a third aspect of the present invention there is provided a method of manufacturing a pressure sensitive thermoplastic sheet material according to the first aspect of the invention and comprising the steps of

coating one side of a clear thermoplastic polyolefin film with a layer of a colourant; and

encapsulating the colourant applied to said one side of the film by covering it with a layer of a pressure-sensitive adhesive.

Preferably, the method comprises the additional step of treating the thermoplastic film with a corona discharge of at least 38 dynes prior to its coating with the colourant. Alternatively, the method comprises the additional step of treating the thermoplastic film with a water-based ink receptive coating prior to its coating with the colourant.

The colourant may be applied to the thermoplastic film by any suitable conventional coating or printing method preferably at a dried rate of between 1 and 15 g/m^2 inclusive.

Preferably, the colourant comprises a water-based thermoplastic acrylic copolymer base and a water miscible pigment and, advantageously for the coating method, the viscosity of the base is reduced to a range of 16 to 20 Ns/m^2 using water.

After coating with the colourant, the thermoplastic film is preferably air dried at a temperature of no higher than 90°C.

Preferably, prior to encapsulation of the colourant, the pressure sensitive adhesive has been previously applied as a coating to one side of a release liner which is then laminated in a dry mode to the thermoplastic film to encapsulate the colourant between the film and the adhesive layer.

Alternatively, the colourant is encapsulated by the application of the adhesive layer directly to it and the method comprises the additional steps of permitting the adhesive layer to dry and of laminating the thermoplastic film with a release liner which covers the adhesive.

Preferably, the adhesive is applied to the release liner or directly to the colourant at a rate of between 20 and 24 g/m^2 inclusive.

To produce a sheet material suitable for use a security label, the method preferably comprises the additional step of applying a luminescent image to said one side of the film prior to coating said one side of the

film with the layer of a colourant, the subsequent coating of the film with the layer of colourant trapping the image therebetween.

Preferably, the luminescent image is applied by printing an image on the film using an luminescent ink which is least infrared readable or ultraviolet readable and in this case the colourant also preferably comprises a wax such that using a Finat Test Method (FTM) 1 with a dry adhesive coating rates of between 20 and 24 g/m^2 inclusive the layer of colourant exhibits a peel figure in a range between 0 and 4 N/25 mm inclusive.

Various aspects of specific examples of the present invention will now be described with reference to the accompanying drawing, in which:-

Fig. 1 is a cross-sectional view of a coloured pressure sensitive thermoplastic sheet material according to the invention to a greatly enlarged scale; and

Fig. 2 is a view similar to Fig. 1 but of a modified sheet material suitable for use a security label or similar.

The sheet material shown in Fig. 1 comprises a clear thermoplastic film 1 which is covered on one side by a layer of colourant 2. The colourant layer 2 is encapsulated by a pressure-sensitive adhesive coating 3 which is itself covered by a release layer 4. In use, the release layer 4 is intended to be peeled off the sheet material prior to use so that the material can be stuck down to a surface as required via the pressure sensitive adhesive.

As previously described, the thermoplastic film 1 is used as a carrier for a layer of colourant 2. The side of the film 1 which is not coated with the colourant may have a gloss finish or a matt finish as desired. The film 1 can be of any suitable thickness according to the use that the finished sheet material is to be put. Typically, the thickness of the film will be between 20 and 130 microns.

Suitable films, which are all commercially available, can be made from polypropylene such as cast type polypropylene or biaxially orientated polypropylene and from polyethylene, polycarbonate, polyolefins and even from uPVC.

In order to ensure that the film will accept the colourant it is necessary to treat any film used with a corona discharge of at least 38 dynes. Alternatively, the film can be treated with a water-based ink receptive coating prior to its coating with the colourant.

If a conventional pressure sensitive adhesive 3 is to be used then it is necessary to use a colourant 2 comprising a water-based thermoplastic acrylic copolymer base and a water miscible pigment. Such bases are also commercially available.

Any suitable conventional coating or printing method, for example by using a gravure roll printer, reverse roll gravure or meyer bar assisted printing methods or an air knife method. The density of application of the colourant will determine the degree of opacity and colour density of the finished material. Preferably, the colourant is applied to the thermoplastic film at a dried rate of between 1 and 15 g/m^2 inclusive.

It is also important that the pigment, which may comprises several tints, is light fast. Preferably, all tints used should be substantially stable under ultraviolet irradiation up to 8 on the Gray scale.

In addition, preferably all tints used to make the pigment have been bead milled prior to mixing to form a master pigment batch.

Bead milling of the pigment assures the tint quality and colour stability of the colourant for an opaque layer of colour. In this respect, preferably the pigment is mixed into a master batch form using the base as a carrier prior to subsequent mixing with further base material to produce the colourant. Bead milling of the master batch is preferably also carried out prior to mixing with the base to form the colourant.

After mixing of the colourant, the viscosity of the base should preferably be reduced to a range of 16 to 20 Ns/m^2 using water (sheen 405/2, ASTMD4212).

After coating with the colourant, the thermoplastic film is air dried at a temperature of no higher than 90°C. Typically, the coating machine will be combined with a forced convection oven and the latter must be of a type which will not mark or scratch the uncoated side of the film and which will give complete drying of the colourant within the aforementioned temperature range. In addition, all oven rollers must be driven at line speed and the oven air drying volumes must be high enough to give complete drying at temperatures no higher than 90°C.

The pressure sensitive adhesive may then be applied directly to the colourant 2, permitted to dry and the coated film laminated to the release liner 4, or be

applied to a release liner 4, dried, for example in a forced convection oven, and the liner 4 laminated to the film 1 so that the adhesive layer lies adjacent to and encapsulates the colourant 2.

Suitable release liners comprises conventional single sided release liners which may comprise glassine paper, clay-coated kraft paper, polyester release film, polypropylene release film and polyethylene release film.

In order to determine the adhesion of the colourant 2 to the film 1 and the adhesive bond to the colourant, a Finat Test Method (FTM) 1 may be used. At dry adhesive coating rates of between 20 and 24 g/m^2 inclusive, the colourant 2 will remain bonded to the film 1 and to the adhesive coating 3 to give clean peels from a glass plate at minimum peel figures of 20 N/25 mm after 24 hours.

Modification of the colourant formulation, primarily by the addition of waxes, can give peel figures in a range between 0 and 4 N/25 mm inclusive which do not give clean peels and thus provide a product which can be termed "tamper evident". This enables the invention to be modified for use to provide a security label or similar for use primarily in the anti-counterfeiting labelling of genuine goods or articles such as automotive parts, pharmaceuticals, perfumes, alcoholic drinks, computers and their components, and official documents.

With reference to Fig. 2, in which identical features to those described with reference to Fig., 1 are referenced with the same number, such a "security" sheet material comprises a clear thermoplastic film 1 which is covered on one side by a layer of colourant 2 that is formulated so as not to give a clean peel as indicated above. However, prior to the coloration process, the film

1 is printed or has otherwise applied thereto a security image 5 in a luminescent ink preferably so as to be either ultraviolet or infrared readable. After the coloration process, the colourant layer 2 is encapsulated by a pressure-sensitive adhesive coating 3 which is itself covered by a release layer 4 as before.

The security image 5 is thus trapped between the film 1 and the colourant layer 2. This leaves the top surface 6 of the film 1 for conventional printing, for example by flexography, letter press, hotfoil, thermal transfer and screen printing methods.

In use as before, the release layer 4 is peeled off the sheet material prior to use so that the material can be stuck down to a surface as required via the pressure sensitive adhesive. However, once stuck down it cannot be removed cleanly owing to the nature of the colourant layer 2. This, therefore, prevents the security image 5 from being removed intact with the colourant layer 2 for misuse elsewhere and also shows up any tampering or attempts to remove a validly affixed label.

Thus the invention provides a method of producing a coloured pressure sensitive thermoplastic sheet material comprising a clear thermoplastic polyolefin film which, unlike equivalent conventional materials, is not only environmentally friendly but is economical to produce in small quantities. This means that large ranges of colours and finishes can be produced. In addition, the sheet material is readily adapted to provide security labels as indicated above which have the same advantages. The finished products in both cases have a long life as thermoplastic polyolefin films are highly resistant to bio-degrading organisms and are stable at normal room and outdoor temperatures.

CLAIMS

1. A pressure sensitive thermoplastic sheet material suitable for use as a self-adhesive label material comprising a clear thermoplastic polyolefin film which is covered on one side by a pressure-sensitive adhesive coating, and characterised in that the adhesive coating encapsulates a layer of colourant applied to said one side of the film.

2. A sheet material as claimed in Claim 1, characterised in that a release liner is provided which covers the adhesive coating and which can be peeled off prior to use of the sheet material.

3. A sheet material as claimed in Claim 1, characterised in that the clear thermoplastic film comprises one of a polypropylene film, polyethylene film, and a polyolefin film.

4. A pressure sensitive thermoplastic sheet material suitable for use as a self-adhesive label material comprising a clear thermoplastic polyolefin film which is covered on one side by a pressure-sensitive adhesive coating, and characterised in that the adhesive coating encapsulates a layer of colourant applied to said one side of the film, the colourant comprising a water-based thermoplastic acrylic copolymer base and a water miscible pigment.

5. A sheet material as claimed in Claim 5 characterised in that the pigment is substantially stable under ultraviolet irradiation up to 8 on the Gray scale.

6. A sheet material as claimed in any one of Claims 1 to 5, characterised in that between the film and the layer of colourant is a luminescent image.

7. A sheet material as claimed in Claim 6, characterised in that the luminescent image comprises an image produced by the application of at least infrared readable or ultraviolet readable ink to the film prior to application of the layer of colourant.

8. A sheet material as claimed in Claim 6 or Claim 7, characterised in that the colourant has a formulation such that using a Finat Test Method (FTM) 1 with a dry adhesive coating rates of between 20 and 24 g/m² inclusive the layer of colourant exhibits a peel figure in a range between 0 and 4 N/25 mm inclusive.

9. A sheet material as claimed in Claim 8, characterised in that the formulation of the colourant comprises a wax.

10. A method of manufacturing a pressure sensitive thermoplastic sheet material as claimed in Claim 1 and comprising the steps of

coating one side of a clear thermoplastic polyolefin film with a layer of a colourant; and

encapsulating the colourant applied to said one side of the film by covering it with a layer of a pressure-sensitive adhesive.

11. A method as claimed in Claim 10, characterised in that it comprises the additional step of treating the thermoplastic film with a corona discharge of at least 38 dynes prior to its coating with the colourant.

12. A method as claimed in Claim 10, characterised in that it comprises the additional step of treating the thermoplastic film with a water-based ink receptive coating prior to its coating with the colourant.

13. A method as claimed in any one of Claims 10 to 12, characterised in that the colourant is applied to the thermoplastic film at a dried rate of between 1 and 15 g/m^2 inclusive.

14. A method as claimed in any one of Claims 10 to 13, characterised in that the colourant comprises a water-based thermoplastic acrylic copolymer base and a water miscible pigment.

15. A method as claimed in Claim 14, characterised in that the viscosity of the base is reduced to a range of 16 to 20 Ns/m^2 using water.

16. A method as claimed in any one of Claims 10 to 15, characterised in that after coating with the colourant, the thermoplastic film is air dried at a temperature of no higher than 90°C.

17. A method as claimed in any one of Claims 10 to 16, characterised in that prior to encapsulation of the colourant, the pressure sensitive adhesive has been previously applied as a coating to one side of a release liner which is then laminated in a dry mode to the thermoplastic film to encapsulate the colourant between the film and the adhesive layer.

18. A method as claimed in any one of Claims 10 to 16, characterised in that the colourant is encapsulated by the application of the adhesive layer directly to it and the

method comprises the additional steps of permitting the adhesive layer to dry and of laminating the thermoplastic film with a release liner, which covers the adhesive.

19. A method as claimed in any one of Claims 10 to 18, characterised in that the adhesive is applied at a rate of between 20 and 24 g/m^2 inclusive.

20. A method as claimed in any one of Claims 10 to 19, characterised in that it comprises the additional step of applying a luminescent image to said one side of the film prior to coating said one side of the film with the layer of a colourant, the subsequent coating of the film with the layer of colourant trapping the image therebetween.

21. A method as claimed in Claim 20, characterised in that the luminescent image is applied by printing an image on the film using an luminescent ink which is least infrared readable or ultraviolet readable.

22. A method as claimed in Claim 20 or Claim 21, characterised in that the colourant comprises a wax such that using a Finat Test Method (FTM) 1 with a dry adhesive coating rates of between 20 and 24 g/m^2 inclusive the layer of colourant exhibits a peel figure in a range between 0 and 4 N/25 mm inclusive.

23. A pressure sensitive thermoplastic sheet material substantially as described herein with reference to Fig. 1 or Fig. 2 of the accompanying drawing.

24. A method of manufacturing a pressure sensitive thermoplastic sheet material substantially as described herein with reference to Fig. 1 or Fig. 2 of the accompanying drawing.

The Patent Office

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Claims searched: 1 to 24

Examiner: R.J.MIRAMS
Date of search: 5 March 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B2E, B5N, B8F (FBG)

Int Cl (Ed.6): B32B 7/02. G09F 3/02, 3/10.

Other: ONLINE: WPI, CLAIMS.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB1133451A	(Minnesota Mining) e.g. claim 3	at least 1 to 3 and 10
X	GB1126399A	(Avery Products) e.g. figure 1	at least 1, 2 and 10
X	GB1093984A	(Dymo Industries) e.g. figure 1	at least 1, 2 and 10
A	EP0148030A2	(Minnesota Mining)	
A	WO95/20632A2	(Leeuwenburgh)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.